¹J Dubois, ¹G Dehaene-Lambertz, ²JF Mangin, ³D Le Bihan, ⁴PS Hüppi, ⁵L Hertz-Pannier. ¹Cognitive Neuroimaging Unit, U 992, INSERM; ²LNAO; ³NeuroSpin, CEA, Gif-sur-Yvette, France; ⁴Pediatrics Department, Geneva University Children's Hospital, Geneva, Switzerland; ⁵LBIOM, CEA, Gif-sur-Yvette, France

Studying how the brain develops and becomes functional is a prerequisite to understand the complexity of developmental pathologies. Thanks to Magnetic Resonance Imaging (MRI), it is now possible to image the baby's brain non-invasively, and to provide subtle correlations between its anatomical development and the early acquisition of cognitive functions.

But imaging the immature brain implies several constraints at the levels of data acquisition and post-processing, because the baby may move, the examination length must then remain short, and because the size of cerebral structures and the image contrast are very different in comparison with the adult brain. Dedicated methodologies must then be applied to provide valid and instructive information on the development of cortical and white matter networks.

In this presentation, I will describe two recent MRI studies which evaluated the setting up of cortical morphology and connectivity under an original perspective. The first study has focused on the cortical folding patterns (formation of gyri and sulci), in pre-term newborns from six to eight months of gestational age, by using T2-weighted conventional MRI. The second study has mapped the organization and maturation of major white matter fiber bundles (commissural, projection, association and limbic fascicles), in one- to four-months-old healthy infants, with diffusion tensor imaging (DTI) and tractography.

Both MRI studies have highlighted spatio-temporal differences in the maturation of brain regions, as well as early anatomical asymmetries between cerebral hemispheres. They have also emphasized the relationships between the structural development of the brain and the infant's psycho-motor acquisitions after birth.

194 ARTERIAL SPIN LABELING MAGNETIC RESONANCE IMAGING TO ASSESS NEONATAL BRAIN PERFUSION

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¹JB De Vis, ²KJ Kersbergen, ¹ET Petersen, ¹J Hendrikse, ²T Alderliesten, ²F Groenendaal, ²LS de Vries, ²MJNL Benders. ¹Radiology, UMC Utrecht; ²Neonatology, Wilhelmina Children's Hospital/UMC, Utrecht, The Netherlands

Background and aim Little is known about brain perfusion in neonates and its relation with brain development. The purpose of this study was to evaluate if Arterial Spin Labeling (ASL) Magnetic Resonance (MR) imaging can be used to evaluate the relation between brain perfusion and brain development.

Methods Pulsed ASL-images (Philips-3T) were acquired of 31 infants. Six infants were imaged at preterm age, 23 infants at term equivalent age (TEA) and 2 infants at 3-months equivalent age (3m). Serial MR imaging was performed in 4 infants. Total brain perfusion (TBP) was measured for each infant. Regions of interest (ROIs) were drawn within the occipital cortex (OC), the frontal cortex (FC) and one ROI covered the basal ganglia and thalamus (BGT). Perfusion values measured in the ROIs were expressed relative to TBP.

Results TBP increased from preterm age (7.1ml/100g.min) to TEA (12.6ml/100g.min) to 3m (30.2ml/100g.min). A relative decrease in perfusion towards the BGT and a relative increase towards the OC and FC was measured with increasing postconceptional age [fig 1]. Serial ASL images of one infant scanned at preterm [Fig.2a] and TEA [Fig.2b] are shown.

Conclusions Arterial Spin Labeling MR images reflect the anatomical and functional maturation of the brain in neonates and are in agreement with previously obtained PET-images.

Abstract 194 Figure 1

Abstract 194 Figure 2

195 REGIONAL CHANGES OF CORTICAL THICKNESS AT 6 YEARS OF AGE IN PRETERM BORN CHILDREN

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¹L Vasung, ²E Fischl Gomez, ³M Monnier, ⁴AC Evans, ²F Lazeyras, ¹C Borradori Tolsa, ¹PS Hüppi. ¹Pediatrics, Service de Développement et Croissance, Geneva University Children's Hospital; ²Radiology, Center for Biomedical Imaging, Geneva University Hospital, Geneva; ³Pediatrics, Children's Hospital, Lausanne, Switzerland; ⁴ACE, Clinical Trials Imaging Lab, McConnell Brain Imaging Centre, Montreal Neurological Institute, McGill University, Montréal, QC, Canada

Background The growing incidence of prematurely born children and the improvement of survival rates have been associated with highly problematic long term neurodevelopmental outcomes. Brain structural alterations associated with these mainly cognitive difficulties most likely involve cortical organization. This study presents new ways of assessing structural organization of the cortex through thickness measurements.

Subjects/methods Preterm infants (N=42, GA 28.7±3.1 wks) were scanned at 6 years of age using the 3T MRI scanner. High-resolution 3D T1 MRI images were analyzed using MNI tools (<http://www.bic.mni.mcgill.ca/~alan/lab.html>). IUGR preterm subjects (N=14) were identified by abnormal antenatal Doppler measurements and mean birth weights below 10th percentile. Cortical thickness was computed between extracted cortical surfaces and analyzed using the SurfStat tools (<http://www.math.mcgill.ca/keith/surfstat/>).

Results GA at birth within all subjects showed positive correlation with cortical thickness measurements (bilateral precuneus, right